REMARKS

The Final Office Action mailed March 14, 2000, has been received and reviewed. Claims 23 through 28 are currently pending in the application. Claims 23 through 28 stand rejected. Applicants propose to amend the specification and respectfully request reconsideration of the application as proposed to be amended herein.

Specification

Applicants respectfully request that the Examiner amend the specification as requested herein to reflect that this application is a divisional of application Serial No. 08/682,935, filed July 16, 1996. This addition was inadvertently omitted from the Preliminary Amendment and subsequent Amendments. A copy of the Utility Patent Application Transmittal is included herewith reflecting that the current application is indeed a divisional of application Serial No. 08/682,935, filed July 16, 1996.

35 U.S.C. § 112 Rejections

Claims 24 and 28 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. More specifically, claims 24 and 28 stand rejected because the specification allegedly does not disclose a crystalline metallic silicide film.

Applicants respectfully traverse this rejection. The specification specifically points out that it is well known in the art that "metallic silicide is annealed to form a crystalline structured metallic silicide film." *See*, Specification, page 5, lines 10-11 (emphasis added). It is also known that when the metallic silicide film is annealed, silicon within the metallic silicide forms "clusters inside the crystalline structured metallic silicide film." *See*, Specification, page 5, lines 13-15. Furthermore, the specification describes a heat cycle to anneal a metallic silicide film, followed by implantation to disperse silicon clusters. *See*, Specification, page 9, lines 21-26. Thus, the

specification describes the annealing of a metallic silicide film, resulting in a crystalline structured metallic silicide film as claimed in claims 24 and 28. Because the specification describes the crystalline structure of an annealed metallic silicide film, the 35 U.S.C. § 112 rejection is inappropriate and should be withdrawn.

35 U.S.C. § 102(e) Anticipation Rejection

Applicant's note that the Examiner has rejected claims 23-28 under 35 U.S.C. § 102(e) as being anticipated by Tung, while providing a quotation of 35 U.S.C. § 102(b) as the basis for the rejection. If the Examiner intended to reject claims 23-28 based upon 35 U.S.C. § 102(b), Applicants would respectfully request that the rejection be withdrawn and the claims allowed for issue because Tung was not "patented...more than one year prior to the date of application for patent in the United States." *See*, 35 U.S.C. § 102(b).

The basis for the rejection is unclear and the previous rejection under Tung was based upon 35 U.S.C. § 102(e), therefore, Applicants will also respond to the Examiner's rejection as if it is a rejection under 35 U.S.C. § 102(e).

Anticipation Rejection Based on U.S. Patent No. 5,728,625

Claims 23 through 28 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Tung, U.S. Patent No. 5,728,625. Applicants respectfully traverse this rejection, as hereinafter set forth.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. Verdegaal Brothers v. Union Oil Co. of California, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. Richardson v. Suzuki Motor Co., 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Tung expressly describes "a process for forming an epitaxial quality cobalt silicide ($CoSi_2$) layer for use in self aligned silicon technology." *See*, Tung, Col. 5, lines 19-21. As the Examiner

summarizes, "Tung discloses that after the cobalt layer 220 is formed on the substrate, the substrate is then annealed to convert the cobalt to cobalt silicide layer." *See*, Official Action, page 3 (emphasis added). Tung specifically describes the following:

> After the cobalt layer is formed on the substrate, the substrate is then annealed. The substrate is kept in an essentially oxygen free environment until after the annealing step. The temperature at which the substrate is annealed is largely a matter of design choice. However, it is advantageous if the temperature is between about 450° C and about 800° C. The substrate is annealed for an amount of time that is sufficient to convert the cobalt to cobalt silicide.

See, Tung, col. 6, lines 11-18 (emphasis added). Thus, Tung teaches that regardless of the temperature required to anneal the cobalt, the cobalt layer is annealed. As described in the specification of the present application, annealing forms a crystalline metallic silicide film. Therefore, Tung inherently describes the formation of a crystalline metallic silicide film rather than a non-crystalline metallic silicide film.

Claims 23, 25, and 27 each recite "a non-crystalline metallic silicide film" which is neither specifically nor inherently described by Tung. Therefore, Tung fails to describe each and every element as set forth in claims 23, 25, and 27. The anticipation rejection of claims 23, 25 and 27 should be withdrawn and the claims allowed and passed for issue.

Furthermore, the rejection of Applicant's arguments in response to the previous Official Action appear to be based upon Tung's teaching that a cobalt layer may be annealed at a temperature lower than that taught in the Applicant's specification. This is not material to the issues at hand, however, as Tung still teaches that the cobalt layer is annealed, which inherently forms a crystalline metallic silicide. Therefore, the teachings of Tung fail to anticipate a non-crystalline metallic silicide film as in claims 23, 25, and 27.

Claims 23-28 are also rejected based upon the contention that Tung discloses the process of the present invention wherein the silicon clusters formed during an anneal are dispersed by the implantation of ions into the annealed metallic silicide film. Citing specific examples in Tung, the Examiner indicates that the doping of a tungsten silicide film will "amorphize the silicide film" and "lead to the silicide film with [sic] substantially devoid of the silicon clusters." Yet Tung does not

disclose the amorphization of a silicide film or a silicide film substantially devoid of silicon clusters. In fact, Tung never describes silicon clustering in metallic silicide films. Instead, Tung discloses the implantation of impurities in a tungsten silicide as is common in the formation of a gate stack having a metallic silicide layer. Applicant's specification also discloses the prior art methods which use such an implantation before an anneal. *See*, Specification, page 3, lines 5-26. Tung also teaches that following the implantation of the dopant into the silicide film "the device is then annealed" to activate the impurities and dope the polycrystalline silicon. As taught by the present invention, the annealing of metallic silicide film causes the formation of silicon clusters within the metallic silicide film. The presence of impurities does not prevent such formation. Tung does not teach otherwise. Therefore, the annealing step following the implantation of impurities as taught by Tung would necessarily result in a metallic silicide film containing silicon clusters.

Furthermore, the present invention includes the implantation of ions to disperse silicon clusters formed in a metallic silicide during an anneal. In other words, Applicant's conduct an ion implantation after an anneal. Tung never mentions this approach. Yet, the rejection is based upon the purported teaching in Tung that silicon clusters may be dispersed by ion implantation following an anneal. Applicant's specification, and not Tung, is the only reference which discloses the dispersion of silicon clusters from an annealed metallic silicide. The Examiner's rejection is therefore improper because it is based upon the teachings of the present invention and the improper use of hindsight.

Claims 24 and 28 of the present invention claim a crystalline metallic silicide, the equivalent of the annealed metallic silicide film in Tung. However, the claims include the further limitation of a crystalline metallic silicide film "substantially devoid of silicon clusters." Tung does not disclose a crystalline metallic silicide film substantially devoid of silicon clusters. Tung also fails to disclose a process by which silicon clusters may be removed from an annealed metallic silicide film. Only the present invention includes ion-implantation following an anneal of a metallic silicide film to disperse silicon clusters formed within a metallic silicide film during the

annealing process. Tung's failure to teach the removal of silicon clusters from an annealed metallic silicide precludes an anticipation rejection of claims 24 and 28 under 35 U.S.C. § 102(e) because a metallic silicide film "substantially devoid of silicon clusters" as recited in claims 24 and 28 is only acheived by the present invention.

Claim 26 of the present invention recites a gate stack on a dielectric layered semiconductor substrate wherein the dielectric layer is "substantially devoid of pitting." As taught in the present invention, the formation of silicon clusters in a metallic silicide film results in an increased etch rate which causes pitting within the dielectric layer. The absence of silicon clusters in the gate stack formations of the present invention results in an un-pitted dielectric layer as claimed in claim 26. Tung does not disclose a process by which silicon clusters may be dispersed from an annealed metallic silicide film, nor do the teachings of Tung disclose that pitting within a dielectric layer may be prevented. Further, Tung fails to recognize, much less teach, why pitting may or may not occur, either expressly or inherently. Thus, Tung does not anticipate claim 26.

Claims 27 and 28 depend from claim 26, and are therefore patentable because they each depend from a non-anticipated independent claim. In addition, claim 27 includes the further limitation of a non-crystalline metallic silicide film which is not taught or suggested by Tung. In fact, Tung teaches an anneal step which results in the formation of a device with a crystalline metallic silicide layer which is different from the gate stack claimed in claim 27. Tung also fails to disclose a crystalline metallic silicide film substantially devoid of silicon clusters as claimed in claim 28, because Tung does not disclose a process by which silicon clusters may be dispersed from a crystalline metallic silicide film.

Because Tung does not disclose, either expressly or inherently, a gate stack having either a non-crystalline metallic silicide film, or a gate stack having a crystalline metallic silicide film substantially devoid of silicon clusters, claims 23-28 are not anticipated by Tung. Applicants respectfully request the withdrawal of the anticipation rejection under 35 U.S.C. § 102(e) and the allowance of claims 23-28.

ENTRY OF AMENDMENTS

The proposed amendments to the specification above should be entered by the Examiner because the amendments do not add any new matter to the application and are in accordance with the rules. Further, the amendments do not raise new issues or require a further search. Finally, if the Examiner determines that the application is not in condition for allowance, entry of the amendments is respectfully requested upon filing of a Notice of Appeal herein.

CONCLUSION

Claims 23 through 28 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully Submitted,

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